

# Generating Innovations for the Internet of Things: Agility and Speed

Introduction to the First International Inno4IoT Workshop

Juan Garbajosa  
Universidad Politécnica de Madrid  
Calle Ramiro de Maeztu, 7  
Madrid, Spain 28040  
jgs@etsisi.upm.es

Mats Magnusson  
KTH Royal Institute of Technology  
Brinellvägen 8  
Stockholm, Sweden 11428  
matsmag@kth.se

Xiaofeng Wang  
Free University of Bozen-Bolzano  
Piazza Università, 1  
Bolzano, Italy 39100  
xiaofeng.wang@unibz.it

## ABSTRACT

The Internet of Things (IoT) bears great potential for innovation in modern companies. Agility and speed both matter when innovating in such a context. The first Inno4IoT workshop focuses on how to properly achieve and balance the two aspects while innovating IoT-based solutions, which represents unique opportunities and challenges to researchers and practitioners alike. An overview of the three working papers presented and published in the workshop is provided in this introductory paper.

## KEYWORDS

Innovation, Internet of Things, IoT, Agility, Entrepreneurship

### ACM Reference format:

Juan Garbajosa, Mats Magnusson, and Xiaofeng Wang. 2017. Generating Innovations for the Internet of Things: Agility and Speed. In *Proceedings of, Cologne, Germany, May 2017 (XP'17 Workshops)*, 2 pages. DOI: 10.475/123\_4

## 1 BACKGROUND

Generating innovations is a must for any technological company that seriously intends to stay alive and prosper [6]. The Internet of the Things (IoT) is a concept that involves thousands of millions of devices, and offers seemingly endless opportunities to generate innovations. IoT opens up for the establishment of new technological platforms as well as new types of ecosystems consisting of e.g. different firms, public organizations, and communities. These ecosystems constitute dynamic environments for the development of IoT technology and for generating innovations [4]. Software is essential to foster all these innovations [1].

However this specific context also brings about numerous challenges. Like in many other industries, the technological life-cycles become shorter year by year, the pressure for reduced time-to-market constantly increases, and customers are becoming ever more demanding and also requires higher degrees of customization [3]. Altogether, this increases the uncertainty associated to

the innovation development process. Some specific features of IoT render innovation in such a context particularly challenging. As IoT comprises numerous different technologies the demand for effective integration is substantial [2]. Moreover, the development of IoT often takes place in networked ecosystems with multiple stakeholders, and this underlines the need to develop suitable business models that allow for fruitful collaboration, value generation and appropriation [7].

In this context, software developers more and more need to attend to innovation in their development work: when developing new and attractive-to-the-customer products with the ambition to become innovations they have to combine creativity, agility and speed to keep up. Creativity is a fundamental resource in an innovation-intensive environment, but needs to be combined with agility in order to effectively introduce flexibility in the process and make decisions to cope with uncertainty. Speed will be required to deal with intensified competition and demands for reduced time to market [3].

## 2 OBJECTIVE AND SCOPE OF INNO4IOT

The objective of the First International Workshop on Generating Innovations for the Internet of Things: Agility and Speed, is to provide a forum for researchers working in different research fields to gather together, and analyze and understand the role that agility plays in generating innovations, which this far is inconclusive and even presents conflicting results. Furthermore, agility needs to be harmonized with speed for effective innovative product development in the context of the Internet of Things. Various research questions can be asked under this broad theme, such as:

- How can we characterize software-based innovations for the Internet of Things?
- How can agile and agility help cope with uncertainty when Generating Innovations for the Internet of the Things?
- How can we make that agility and agile values and speed co-exist in the IoT context?
- How is creativity influenced by agile approaches in development?
- Can learning be better deployed for innovation in agile?
- Does effective learning help speed up the development process?
- Are investment models similar to those of conventional projects?

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from [permissions@acm.org](mailto:permissions@acm.org).

*XP'17 Workshops, Cologne, Germany*

© 2017 ACM. 978-1-4503-5264-2/17/05...\$15.00

DOI: 10.475/123\_4

To answer these questions, various overlapping and interlinking topics, aligned with the main theme of the workshop, can be explored. Some exemplar topics are listed as follows:

- The roles of business and software engineering practices in innovation
- Product roadmap for innovations
- Agile values and principles in innovation
- Learning in agile
- Indicators for pivoting
- Indicators for reducing the distance between products and customers
- Economic models for investment in innovative software product development
- Obstacles that slow down development speed
- Development Models based on experiments

### 3 OVERVIEW OF THE CONTRIBUTING PAPERS

Three papers were submitted, presented and discussed extensively at the first IoT workshop, and were improved and published after the workshop. They are good examples of how several key topics of the workshop could be integrated and form emerging and interesting new research strands.

Guided by a vision that environmental data must be available by everyone and shared with citizens, but it must also be unmodifiable, the authors of “*CitySense: Blockchain-oriented Smart Cities*” propose to monitor the environment quality in urban area by means of a distributed network of small mobile sensors connected via Internet. The storage and management of sensor data utilize blockchain technology and smart contracts. The software based on blockchain was developed applying SCRUM in close collaboration with the citizens.

The paper “*An Analysis of the Bluetooth Terminal Development Pivots from Lean Startup perspective: Experience and Lessons Learnt*” reconstructs the development process of “*Bluetooth terminal*”, a tool to monitor bluetooth devices, and reflects on the major pivots made along the way. The case of “*Bluetooth terminal*” demonstrates the value of following the build-measure-learn loop suggested by the Lean Startup approach [5] in the context of IoT. It also shows how pivots can be determined based on the continuous monitoring of users’ feedback in such a context.

The third paper, entitled “*Security Challenges in IoT Development: A Software Engineering Perspective*”, contends that engineering approaches for secure IoT development are receiving increasing attention with the rapid growth of IoT software applications. The authors investigated security challenges in the context of agile development and IoT products. Through reviewing relevant literature and studying two industry cases, they identified 17 security challenges with regards to technical, organizational and methodological perspectives. The ultimate goal of the work is to build a methodological approach for security in the IoT context,

In brief, together with these three papers and the workshop participants, the first Inno4IoT contributes to the growth of a community of researchers from different research areas to collaborate and explore the new innovation potentials presented by the Internet of Things. As the title of this introduction suggests, agility and

speed both matter when innovating in the context of IoT. How to properly achieve and balance both represents unique opportunities and challenges to researchers and practitioners alike. We look forward to an increasing amount of research in this exciting arena.

### ACKNOWLEDGMENTS

The authors would like to thank the support from the Software Startup Research Network ([www.softwarestartups.org](http://www.softwarestartups.org)), cpselabs (Juan: more to say here), and all the participants of the first Inno4IoT workshop.

### REFERENCES

- [1] Marc Andreessen. 2011. Why Software Is Eating the World. *Wall Street Journal* 20 Aug. (2011). <https://www.wsj.com/articles/SB10001424053111903480904576512250915629460>
- [2] Luigi Atzori, Antonio Iera, and Giacomo Morabito. 2010. The Internet of Things: A survey. *Computer Networks* 54, 15 (2010), 2787 – 2805. DOI : <http://dx.doi.org/10.1016/j.comnet.2010.05.010>
- [3] Jan Bosch. 2016. Speed, Data, and Ecosystems The Future of Software Engineering. *IEEE Software* 33, 1 (2016), 82–88. <http://sarec.nd.edu/courses/SE2017/FutureOfSE.pdf>
- [4] Daniele Miorandi, Sabrina Sicari, Francesco De Pellegrini, and Imrich Chlamtac. 2012. Internet of things: Vision, applications and research challenges. *Ad Hoc Networks* 10, 7 (2012), 1497 – 1516. DOI : <http://dx.doi.org/10.1016/j.adhoc.2012.02.016>
- [5] Eric Ries. 2011. *The lean startup: How today’s entrepreneurs use continuous innovation to create radically successful businesses*. Crown Books.
- [6] Michael Treacy and Fred Wiersema. 1995. *The discipline of market leaders: Choose your customer, narrow your focus, dominate your market*. Addison-Wesley, Reading, Mass.
- [7] Li Da Xu, Wu He, and Shancang Li. 2014. Internet of Things in Industries: A Survey. *IEEE Transactions on Industrial Informatics* 10, 4 (nov 2014), 2233–2243. DOI : <http://dx.doi.org/10.1109/TII.2014.2300753>